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S/P Right Hip ORIF

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S/P RIGHT HIP ORIF

by

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This Scholarly Project, submitted by Brian Bartow in partial fulfillment of the requirements for the Degree of Doctor of Physical Therapy from the University of North Dakota, has been read by the Advisor and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

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ABSTRACT

Background and Purpose: Hip fracture is a major medical problem among older adults, leading to impaired balance and gait and loss of functional independence. An open reduction internal fixation (ORIF) is a method of surgically repairing a fractured bone. Generally, this involves either the use of plates and screws or an intramedullary (IM) rod to stabilize the bone. **Case Description:** The patient was a 51-year-old female who fractured her right hip while running. She had complained of thigh pain with running for 1 to 2 months prior. She had gamma nail pinning. **Intervention:** The focus of treatment was to increase mobility, range of motion (ROM), and strength. Also, increase ambulatory and functional independence with and without assistive device in order to return to prior level of function. **Outcomes:** The patient reached all of her short and long term goals. By discharge, she ambulated without compensation or a limp and her right hip ROM measures were all within functional limits. **Discussion:** At times it was difficult to know if the patient was following her weight bearing (WB) precautions because she came into the clinic sore almost every session for the first two week. Following a course of progressive strength training the patient not only improved her gait but also all activities of daily living (ADL's).

CHAPTER I

BACKGROUND AND PURPOSE

Hip fracture is a major medical problem among older adults, leading to impaired balance and gait and loss of functional independence. An open reduction internal fixation (ORIF) is a method of surgically repairing a fractured bone. Generally, this involves either the use of plates and screws or an intramedullary (IM) rod to stabilize the bone. Restoration of alignment and good compression is obtained via fixation with three compression screws. Kisner and Colby[1] found an ORIF surgical intervention is indicated for the following types of fractures of the proximal femur; displaced or nondisplaced intracapsular femoral neck fractures, fracture-dislocations of the head of the femur, stable or unstable intertrochanteric fractures, and subtrochanteric fractures. The majority of the studies published on hip fractures/ORIFs are mainly focused on the elderly population. The patient we worked with was a 51 year old female who fractured her hip while running that required her to have an ORIF of the hip. Hip fractures are more common in the elderly accounting for more than 70% of hip fractures occurring in individuals who are greater than 70 years of age. Of that, 90% of hip fractures in the elderly are associated with a fall. Shumway-Cook et al[2] found that 53% of older adults who sustained a hip fracture related to a previous fall experience another fall within 6 months of discharge from the hospital. Even

though our patient was not elderly, the information from Shumway-Cook[2] can apply to our patient who had the bone density comparable to an 80 year old woman. This places her at a higher risk for future fractures, which could come from a fall. Hip fractures occur in women significantly more often than in men.[1] According to Kisner and Colby,[1] fewer than 2% to 3% of fractures are sustained by persons who are less than 50 years of age.

The patient had osteoporosis, which we did not find out until the last two weeks of treatment. Osteoporosis is a condition associated with age-related loss of bone density and strength, typically occurring in the proximal femur, distal radius, and spine. Osteoporosis is a disease in which bones become fragile and more likely to fracture. Drăgoi et al[3] performed a study showing hip fracture incidence was two times more frequent in women than in men. This patient was a middle-aged woman who experienced a hip ORIF and was later told she had osteoporosis. Korpelainen et al[4] performed a study on the effect of exercise on extraskeletal risk factors for hip fractures in elderly women with low bone mineral density (BMD). The participants were healthy 70 to 73 year old women who did not require an assistive device. They were randomly assigned to either 30 months of impact, balance, and strength exercises or no intervention. They found the exercise group had a decreased body sway time, increased walking endurance, increased maximal isometric leg strength, and increased walking speed compared to the control group that had no intervention. Minimal research and information are available for middle aged people who sustain a hip fracture. More research on middle-aged people with hip fractures is needed so physical

therapists have better evidence-based knowledge in the treatment of hip fractures. In addition, it would differentiate treatment options in middle-aged patients compared to elderly patients.

As Physical Therapists, our concern after a hip fracture is how much weight the patient is able to bear on the involved extremity. This could help determine the types of interventions used for rehabilitation. Cipriani et al[5] studied the reliability and validity of a partial weight bearing measure of lower extremity performance and found using the incline apparatus yielded reliable partial weight bearing data. Following 4 to 6 weeks of rehabilitation intervention the patients exceeded the minimal detectable change and the limb symmetry index improved in all patients. Hurkmans et al[6] examined the validity and interobserver reliability of visual observation to assess partial weight bearing. Visual observation was measured with the visual analog scale score and actual weight bearing was measured with the Pedar system and the standard deviation of the differences was determined by the limits of agreement method. The study consisted of 10 physical therapists (5 experienced and 5 inexperienced in training patients in partial weight bearing). There was no effect on the mean difference between the experienced and inexperienced physical therapists in partial weight bearing training. They concluded visual observation is not valid or reliable to assess the patient's partial weight bearing status. Sherrington et al[7] compared the difference in weight bearing and non weight bearing exercise for improving physical ability after a hip fracture. There were 120 participants in this study with ages ranging from 57 to 97. The two groups were given a home exercise program and a

control program on physical ability in strength, balance, gait, and functional performance. After 4 months of the program, 90% completed, the patients were retested. The weight bearing program showed better results in improved balance and functional ability but not in strength or gait compared to the non weight bearing program after a hip fracture.

After experiencing a hip fracture the main goal is to regain the patient's pre-injury ambulatory level. Regaining prior ambulatory level without compensation or utilizing an assistive device is one of the hardest things to regain. Barnes and Dunovan[8] did a study on the ability to achieve independent ambulation after hip fracture, orthopedic stabilization, and subsequent rehabilitation in 65 inpatients in a specialized geriatric rehabilitation center. Even though the patient we worked with was only 51 years old this study will help one understand the importance of regaining prior ambulatory level after a hip fracture. In the study the physical therapists evaluated and treated each patient. The physical therapists documented contractures and ambulatory status after 60 days of therapy and at discharge. They found 83% of the patients reached independence in ambulation sometime between the date of surgery and one year post operation.

Rehabilitation interventions and physical activity during rehabilitation are key to recovery after a hip fracture. Chudyk et al[9] performed a systematic review of hip fracture rehabilitation practices in the elderly to address the effectiveness of rehabilitation interventions for older adults. They discovered that the most frequently reported positive outcomes were with measures of ambulatory ability.

Talkowski et al[10] studied patient participation and physical activity during rehabilitation to determine if it correlated with the patient's future functional outcomes. Eighteen participants, 60 years or older, were recruited from skilled nursing facilities and inpatient rehabilitation facilities. They predicted that participants who were more active in rehabilitation would have higher participation scores and better functional outcomes. The patients' physical activity was recorded using the actigraph accelerometer and the Pittsburgh Participation Rating Scale. It was shown the patients who were more active during rehabilitation reported better functional abilities and were able to achieve 78% to 91% recovery of self-reported pre-fracture compared to the less active participants.

As Physical Therapists we will see multiple hip fractures throughout our career in which some result from sports-related activities and the majority by osteoporosis. People who are less than 50 years of age with hip fractures or fracture-dislocations are usually associated with high-force, high-impact trauma but may also be seen with repetitive microtrauma.[1] Cichy et al[11] performed a case report on atypical femoral neck stress fracture occurring in a 23-year-old male marathon runner. The patient was a healthy individual who was an avid marathon runner prior to his injury. Runners are more susceptible to stress fractures due to repetitive impacts. They concluded amateur athletic activities should raise suspicion for stress fractures on the femoral neck in healthy adults that present with atypical hip pain.

CHAPTER II

CASE DESCRIPTION

The patient was a 51-year-old female who, on June 12, 2012, fractured her right hip while running. She had complained of thigh pain with running for 1 to 2 months prior. The patient thought she had a torn quadriceps, so she went to a physician in Bismarck, ND. After seeing the physician, it was confirmed by an x-ray she had a hip fracture. The physician prescribed her medication and crutches to utilize until she had surgery. She had gamma nail pinning in Gillette, Wyoming on June 27, 2012. There were no complications during surgery. She was toe touch weight-bearing (TTWB) on July 31, 2012 until her next doctors visit.

Examination, Evaluation and Diagnosis

The patient arrived to our clinic on crutches and unable to ambulate with a normal gait pattern. The patient rated her pain as a 0/10 at that time and 2/10 at worst. The patient stated that transfers aggravated her and rest, ice, compress, elevate (RICE) was the only activity that relieved her pain. She had no significant past medical or family history. The patient's incisions were well healed and free of signs and symptoms of infection. Her incisions were hypomobile and tender directly over her greater trochanter.

The patient had a desk job in Baltimore, where she lived, but she was on vacation in Wyoming. The physician ordered her not to fly home due to surgical

precautions. Her precautions were; not to cross legs or ankles when sitting, standing, or lying down, not to bend too far forward at the waist, and to avoid hip flexion greater than 90 degrees. She was living with her sister in Gillette, WY until the physician cleared her to fly again. The patient's sister gave her rides to physical therapy every day and helped her out around the house if needed. Prior to her hip fracture, she was a very active individual who enjoyed running, wakeboarding, and other outdoor activities. Prior to this injury, the patient had no previous injuries to either hip. "Women who regularly walked for exercise had a 30 percent lower risk of hip fracture than women who did not walk regularly. Risk tended to decrease as the distance walked per day increased (relative risk, 0.9 per five blocks walked per day; 95 percent confidence interval, 0.8 to 1.0)."[12] She was not on any medication. Patient's goals were to regain range of motion (ROM), strength, normal gait pattern, and return to all leisure activities. The patient was referred from her physician to our clinic for physical therapy. During her initial evaluation, she had some limitations in her right lower extremity, which was expected due to her procedure. We performed lower extremity manual muscle tests and measured ROM using a goniometer. We performed manual muscle testing and goniometry measurements because there is positive research on the validity and reliability of these tests. Perry et al[13] found the reliability of manual muscle testing showed excellent agreement at 82%. Mutlu et al[14] performed a study on the reliability of goniometric measurements in children with spastic cerebral palsy which found each measure had a 95% confidence interval (CI), interclass correlation coefficients (ICCs) were 0.60 to 0.80 which indicated

good reliability. Special tests were not performed because her diagnosis was already known. The patient's ROM measurements are found in table 1.

Table 1. Initial range of motion measurements.

Right Hip ROM	**Measurement in Degrees**
Flexion	78
Extension	0
Abduction	25
Adduction	N/A
Internal Rotation (IR)	25
External Rotation (ER)	25
Left Hip ROM	
Flexion	Within Normal Limits (WNL)
Extension	WNL
Abduction	WNL
Adduction	WNL
IR	WNL
ER	WNL

Manual muscle testing of the right lower extremity was 3/5 throughout. Manual muscle testing of the left lower extremity revealed flexion, extension, abduction, adduction, IR were 5/5 and ER was 4/5. All myotomes were intact on both lower extremities.

Prognosis and Plan of Care

Based on initial examination and evaluation, physical therapy services were necessary to increase lower extremity ROM and strength. The patient's short term goals were: 1) to improve right (R) hip flexion to 110 degrees per protocol and without pain for increased independence with activities of daily living (ADL's) 2) to progress to partial weight bearing. The patient's long term goals were: 1) to demonstrate 95% R hip AROM for increased independence with ADL's 2) to ambulate up and down stairs with rail assist, safely, confidently and without compensation 3) to be independent and compliant with personal home exercise program (HEP). The patient was treated 2-3x a week for 8 weeks.

Chapter III

Intervention

Weeks 1 to 2 goals were to prevent wound complication, decrease acute symptoms, maintain WB precautions, teach self management with focus on transfer skills, and avoid movements that stressed the fractures. During the first two weeks, the patient performed ankle pumps, passive range of motion (PROM), and active assistive range of motion (AAROM) of affected limb. Penrod et al[15] found with more physical therapy immediately after a hip fracture surgery was associated with better locomotion 2 months later. With each additional session there was an increase of 0.4 points (P=.032) on the 14-point locomotion scale. (Penrod et al, 2004[15]) Passive stretching, postural correction during transfers and gait training with WB precautions to prevent development of a faulty hip mechanics, assistive device training, gait training, sitting tolerance, progress standing tolerance, and walking tolerance were practiced with weight bearing (WB) precautions and assistive device.

Also during the first two weeks, the patient performed quad sets, side-lying clams, side lying hip abduction, prone hip extension, and prone hamstring curls with a red theraband on the first visit. At this time we did not know the diagnosis of the patients osteoporosis but Howe et al[16] found the most effective type of exercise intervention on bone mineral density is non-weight bearing high force

exercise such as progressive resistance strength training. On the second visit, we added a second set to each exercise, added a two pound weight on prone hip extension, and increased the theraband resistance to orange for prone hamstring curls. Starting the third session, we added short arc quads with a three-pound ankle weight, bridges, long arc quads with a three-pound ankle weight, seated hamstring curls utilizing an orange theraband, and seated heel raises. After each session, manual hip stretching/ROM was performed. Manual stretching/ROM consisted of hip flexion (not past 90 degrees), external rotation (ER), internal rotation (IR) (not past neutral), abduction, adduction (not past neutral), and extension.

Weeks 2 to 6 goals were to increase mobility, increase neuromuscular control of postural muscles, increase strength and neuromuscular control of affected limb, learn safe body mechanics, increase functional skills, and progress WB precautions per medical doctor (MD) orders. During this time, we began WB activities while following WB precautions, progressed ambulation to uneven surfaces, progressed AAROM to AROM, progressed therapeutic exercises by increasing difficulty and/or repetitions, started functional exercises, and progressed gait distance while decreasing level of assistance.

Weeks 2 to 6 consisted of the same exercises as the weeks before with a few changes. We added a yellow resistance theraband to side lying clams and side lying abduction, increased prone hip extension to three pounds, and increased prone hamstring curls to a green theraband. Teyhen and Robertson[17] performed a study with 20 healthy people and had them perform 11 different hip

exercises commonly used for rehabilitation. They found 5 specific exercises worked best to target the gluteus maximus and gluteus medius: the clam, the single-leg bridge, hip extension while on both hands and knees, and the sidestep. Barnes and Dunovan[8] found 63% of patients who had a hip abductor strength of a fair plus grade were able to independently ambulate at discharge. Engsberg et al[18] found that by maximizing hip muscle strength may improve gait, and improvement in gait will likely improve functional outcome for the patient. Single leg raise flexion, single leg bridge, squat lunge in the rack, gait training, sit to stands, terminal knee extension (TKE) with a blue theraband, lateral step ups, and seated rows were all added to weeks 2 to 6 therapeutic exercises.

Weeks 6 to 12 goals were to increase mobility of hip joint, increase ambulatory and functional independence with and without assistive device, increase dynamic control, increase cardiovascular endurance, and return to prior level of function. During this time, we increased aerobic activity and intensity, and balance training.

Three months post-op after hip fracture, most people are discharged from physical therapy. Host et al[19] performed a study with 31 older adults who had a surgical repair to their hip fracture 16 weeks prior to the study. The 31 participants completed 3 months of light resistance and flexibility exercises followed by 3 months of progressive resistance training (PRT). They found the participants increased knee extension and leg press 1-repetition maximum. This study also showed working at high intensities can increase ones strength gains. During weeks 6 to discharge (D/C), she continued to perform the same exercises

from the weeks before with changes in resistance when needed. The therapeutic exercises added to her daily routine were the recumbent bike for ten minutes at 75 revolutions per minute (RPM), eccentric step downs on a six-inch step, retro treadmill for seven minutes, Russian dead lifts (RDLs), eccentric leg press at 60 pounds, single leg stance on the dyna disc for two sets of fifteen seconds on each leg, leg press at 80 pounds, agility ladder, split squat, single leg squat in the rack, and band walks with a yellow theraband four times up and down the length of the clinic. Korpelainen et al[4] found the exercise group in their study had a decrease body sway time, increased walking endurance, increased maximal isometric leg strength, and increased walking speed compared to the control group that did not have an intervention component.

Chapter IV

Outcomes

The patient reached all of her short term goals which were: 1) to improve right (R) hip flexion to 110 degrees per protocol and without pain for increased independence with activities of daily living (ADL's). 2) to be progressed to partial weight bearing per MD. The patient reached all of her long term goals as well which were: 1) to demonstrate 95% right (R) hip AROM for increased independence with activities of daily living (ADL's). 2) to ambulate up and down stairs with rail assist, safely, confidently and without compensation. 3) to be independent and compliant with personal home exercise program (HEP). The patient's final ROM measurements are found in table 2.

Table 2. Final range of motion measurements.

Right Hip ROM	**Measurements in Degrees**
Flexion	120
Extension	0
Abduction	43
Adduction	25
IR	40
ER	40

Left Hip ROM	
Flexion	WNL
Extension	WNL
Abduction	WNL
Adduction	WNL
IR	WNL
ER	WNL

By discharge, she ambulated without compensation or a limp. She ascended and descended stairs without compensation and without the use of the handrails for assist. The patient walked on the treadmill at 3 miles per hour (mph) at a 3-degree angle of incline for 7 minutes without resting. The patient had positive results with gait mobility when utilizing the treadmill but Handoll et al[20] found in single trials there was no significant improvement in mobility with gait retraining with a treadmill. She also performed ladder drills and 6-inch hurdle drills without compensation. The patient was very compliant to treatment and personal home exercise program (HEP). At times, we had to remind her to "not overdo it." We would keep her informed on which exercises she could progress. The patient was very happy with her results from her physical therapy sessions. She did not think she would be able to perform the activities she was performing at the end of treatment when she initially started physical therapy.

CHAPTER V

DISCUSSION

During the first few weeks, our main focus was to prevent wound complication, decrease acute symptoms, increase ROM, maintain weight bearing (WB) precautions, teach self management with focus on transfer skills, and avoid movements that stress the fractures. At times it was difficult to know if the patient was following her WB precautions because she came into the clinic sore almost every session for the first two week. We did not know why she came to each session sore; whether it was the treatment or if she did activities she was not supposed to.

Throughout the later weeks of treatment, we focused mainly on muscle strengthening, gait retraining, and functional retraining. Gluteal, hip abductor, and quadriceps strengthening helped reduce and eventually eliminate her antalgic gait pattern. Progressive strength training showed not only to improve the patients gait but also improved all ADL's. The treatment we performed went very well.

Overall, the patient was compliant and responded well to treatment. When the patient first arrived, she was barely able to put any weight on her right (R) leg and did not think that she would be able to return to her previous lifestyle. The patient attended therapy for a little over 8 weeks. At times, the patient would get

frustrated with the slow progression of therapy but she understood the precautions we took were necessary. The patient was very compliant in therapy and with her HEP which helped her progress with some activities at a faster rate than if she was not compliant. By the end of her therapy sessions the patient was able to ambulate without compensation and was able to ascend and descend stairs without the assist of the rails.

Reflective Practice

Studies show that regaining normal gait pattern after a hip fracture is the main focus of intervention before discharge the patient. Our main focus was to regain the patients gait pattern and get her back to her normal active lifestyle, which included running daily and wake boarding. Strengthening, functional re-training, and gait re-training went very well for our patient throughout the entire treatment. The majority of research on hip fracture that is currently available focuses on the elderly population, which made it difficult to find research for middle aged people. The patient we worked with was not only a middle aged woman with a hip fracture but she also had osteoporosis. The patient fractured her hip while running when she stepped off of a curb and following felt a sharp pain in her leg. If she continues to train like she does without any change in her bone density, she will more than likely experience another fracture. A healthy/athletic 51 year old, middle aged, woman with osteoporosis who experienced a hip fracture is a rare occurrence. We did not know that she had osteoporosis until the very end of treatment. Her physician was curious why she was not progressing the way she should since she was a very active individual.

He did a bone mineral density (BMD) test and found out she had osteoporosis. If we would have known the patient had osteoporosis from the beginning of treatment we could have done things differently in order to try and regain her bone density while working on her gait. If I had to do it all over again I would not change any part of the plan of care. The patient was very pleased with her results and we were happy with her results as well.

REFERENCES

1. Kisner C, Colby LA. Therapeutic Exercise, Foundations and Techniques. 5th ed. Philadelphia, PA: FA Davis Co; 2007.

2. Shumway-Cook A, Ciol MA, Gruber W, Robinson C. Incidence of and risk factors for falls following hip fracture in community-dwelling older adults. Phys Ther. 2005;85(7):648-655.

3. Drăgoi D, Popescu R, Trăistaru R, et al. A multidisciplinary approach in patients with femoral neck fracture on an osteoporotic basis. Rom J Morphol Embryol. 2010;51(4):707-711.

4. Korpelainen R, Keinänen-Kiukaanniemi S, Heikkinen J, Väänänen K, Korpelainen J. Effect of exercise on extraskeletal risk factors for hip fractures in elderly women with low BMD: a population-based randomized controlled trial. J Bone Miner Res. 2006;21(5):772-729.

5. Cipriani DJ, Haines M, O'Rand D, Levy S. Reliability and validity of a partial weight bearing measure of lower extremity performance. North Am J Sports Phys Ther. 2009;4(2):49-59.

6. Hurkmans HL, Bussmann JB, Benda E. Validity and interobserver reliability of visual observation to assess partial weight-bearing. Arch Phys Med Rehabil. 2009;90(2):309-313.

7. Sherrington C, Lord SR, Herbert RD. A randomized controlled trial of weight-bearing versus non-weight-bearing exercise for improving physical ability after usual care for hip fracture. Arch Phys Med Rehabil. 2004;85(5):710-716.

8. Barnes B, Dunovan K. Functional outcomes after hip fracture. Phys Ther. 1987; 67:1675-1679.

9. Chudyk AM, Jutai JW, Petrella RJ, Speechley M. Systematic review of hip fracture rehabilitation practices in the elderly. Arch Phys Med Rehabil. 2009;90(2):246-262.

10. Talkowski JB, Lenze EJ, Munin MC, Harrison C, Brach JS. Patient participation and physical activity during rehabilitation and future functional outcomes in patients after hip fracture. Arch Phys Med Rehabil. 2009;90(4):618-622.

11. Cichy B, Roche SJ, Wozniak A. Atypical femoral neck stress fracture in a marathon runner: a case report and literature review. Ir J Med Sci. 2012;181(3):427-429.

12. Cummings SR, Nevitt MC, Browner WS, et al. Risk factors for hip fracture in white women. Study of Osteoporotic Fractures Research Group. N Engl J Med. 1995;332(12):767-773.

13. Perry J, Weiss WB, Burnfield JM, Gronley JK. The supine hip extensor manual muscle test: a reliability and validity study. Arch Phys Med Rehabil. 2004;85(8):1345-1350.

14. Mutlu A, Livanelioglu A, Gunel MK. Reliability of goniometric measurements in children with spastic cerebral palsy. Med Sci Monit. 2007;13(7):CR323-329.

15. Penrod JD, Boockvar KS, Litke A, Magaziner J, Hannan EL, Halm EA, Silberzweig SB, Sean Morrison R, Orosz GM, Koval KJ, Siu AL. Physical therapy and mobility 2 and 6 months after hip fracture. J Am Geriatr Soc.2004;52.

16. Howe TE, Shea B, Dawson LJ, et al. Exercise for preventing and treating osteoporosis in postmenopausal women. Cochrane Database Syst Rev. 2011;(7):CD000333.

17. Teyhen D, Robertson J. Strengthening your hip muscles: some exercises may be better than others. J Orthop Sports Phys Ther. 2013;43(2):65.

18. Engsberg JR, Steger-May K, Anglen JO, Borrelli J. An analysis of gait changes and functional outcome in patients surgically treated for displaced acetabular fractures. J Orthop Trauma. 2009;23(5):346-353.

19. Host HH, Sinacore DR, Bohnert KL, Steger-may K, Brown M, Binder EF. Training-induced strength and functional adaptations after hip fracture. Phys Ther. 2007;87(3):292-303.

20. Handoll HH, Sherrington C, Mak JC. Interventions for improving mobility after hip fracture surgery in adults. Cochrane Database Syst Rev. 2011;(3):CD001704.